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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/521,546

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Anthony Thomas Harcombe

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EXAMINER

COLEMAN, KEITH A

ART UNIT

PAPER NUMBER

3747

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PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/521,546	<b>Applicant(s)</b> HARCOMBE ET AL.	
	<b>Examiner</b> KEITH COLEMAN	<b>Art Unit</b> 3747	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-12 is/are pending in the application.  
4a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-12 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 13 January 2005 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
  3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. ____. |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date <u>1/13/2005</u> . | 6) <input type="checkbox"/> Other: ____.  |

## **DETAILED ACTION**

### ***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1, 2, 7, and 8 are rejected under 35 U.S.C. 102(b) as being anticipated by Ohmori et al. (US Patent No. 4,653,448).

With regards to claim 1, the patent to Ohmori et al. discloses a control method for a fuel injection system having a spill valve (i.e. injection plunger 74 actuated by solenoid actuator 52 via passages 36 and 34, Col. 3, Lines 41-50 and Col. 4, Lines 1-10 and 60-68), nozzle control valve (126) and a valve needle (124) which is engageable with a seating (i.e. interior seating for nozzle 18, See Figure 1) to control fuel injection, the method comprising: applying a first drive current signal (See Figure 2D) to the spill valve (74) to move the spill valve (74) into a closed state and applying a second drive current signal (Figure 2F) to the nozzle control valve (126) to move the nozzle control valve (126) to an open state, thereby to lift the valve needle (124) from the seating to initiate a main injection of fuel, and modifying the first drive current signal (Figure 2D) applied to the spill valve (74) so as to move the spill valve (74) from the closed state to an open state during a spill valve opening period (Figure 2D) and modifying the second drive current signal (Figure 2F) applied to the nozzle control valve (126) to move the nozzle

control valve (126) from the open state to a closed state during the spill valve (74) opening period, so as to urge the valve needle (124) towards its seating to terminate the main injection of fuel (See Figure 2).

With regards to claim 2, the patent to Ohmori et al. discloses including switching the fast drive current signal (via control signal from Driver circuit 68 to actuator 52, See Col. 4, Lines 11-20) off to provide a first actuation pulse (See Figure 2D) to initiate the spill valve (74, See Figure 2D) opening period (Figure 2D shows time versus opening for the spill port) and switching the first drive current signal (Figure 2D) on and then off again to provide a second actuation pulse (Figure 2F) prior to termination of the spill valve opening period (See Figure 2).

With regards to claim 7, the patent to Ohmori et al. discloses wherein the second drive current signal (Figure 2F) is switched on to move the nozzle control valve (126) to its open state.

With regards claim 8, the patent to Ohmori et al. discloses wherein the second drive current signal (Figure 2F) is switched off to move the nozzle control valve (126) to its open state.

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 5 and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ohmori et al. (US Patent No. 4,653,448).

With regards to claim 5, the patent to Ohmori et al. discloses all the limitations of the claimed subject matter including wherein the first drive current signal (Figure 2D) is modified to cause the spill valve (74) to move towards its open state at a time before a time at which the second drive current signal (Figure 2F) is modified to cause the nozzle control valve (126) to move towards its closed state, except positively disclosing a time of between 0.05 and 2 milliseconds.

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify the opening and closing times of the spill and nozzle control valves of Ohmori et al. with a time of between 0.05 and 2 milliseconds, because the modification is invariably an optimized range. See MPEP 2144.04. *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955) (Claimed process which was performed at a temperature between 40°C and 80°C and an acid concentration between 25% and 70% was held to be *prima facie* obvious over a reference process which differed from the claims only in that the reference process was performed at a temperature of 100°C and an acid concentration of 10%.); see also *Peterson*, 315 F.3d at 1330, 65 USPQ2d at 1382 (“The normal desire of scientists or artisans to improve upon what is already generally known provides the motivation to determine where in a disclosed set of percentage ranges is the optimum combination of percentages.”)

With regards to claim 6, the patent to Ohmori et al. discloses all the limitations of the claimed subject matter except positively disclosing wherein the first drive current

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signal is modified between 0. 1 and 1 millisecond before the second drive current signal is modified.

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify the valve timing of Ohmori et al. with wherein the first drive current signal is modified between 0. 1 and 1 millisecond before the second drive current signal is modified, because the modification is invariably an optimized range. See MPEP 2144.04. *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955) (Claimed process which was performed at a temperature between 40°C and 80°C and an acid concentration between 25% and 70% was held to be *prima facie* obvious over a reference process which differed from the claims only in that the reference process was performed at a temperature of 100°C and an acid concentration of 10%.); see also *Peterson*, 315 F.3d at 1330, 65 USPQ2d at 1382 (“The normal desire of scientists or artisans to improve upon what is already generally known provides the motivation to determine where in a disclosed set of percentage ranges is the optimum combination of percentages.”)

Claims 3 and 4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ohmori et al. (US Patent No. 4,653,448) in view of Archer et al. (US Patent No. 5,825,216)

With regards to claim 3, the patent to Ohmori et al. discloses all the limitations of the claimed subject matter except positively disclosing monitoring a glitch detection signal indicative of spill valve opening and modifying the first drive current signal to provide the second actuation pulse at a time, relative to termination of the spill valve opening period, in dependence upon the glitch detection signal.

Archer et al. discloses monitoring a glitch detection signal (Col. 3, Lines 3-11).

Since Archer et al. explicitly states on Col. 1, Lines 9-14 that "This invention relates to a drive circuit for controlling the flow of current in the solenoid of an electromagnetically operable valve in particular but not exclusively, a spill control valve of a fuel injection system for a compression ignition engine." And explicitly states on Col. 3, Lines 3-11 that "This period of current decay is arranged so that closure of the valve member takes place therein and at the instant of closure a small glitch or discontinuity occurs in the current waveform. This is detected [i.e. monitored] by the sensing circuit 29. Following the glitch or a predetermined time after opening the switch 26, it is reclosed and then switched to maintain a mean level of holding current for so long as it is required to maintain the spill valve closed. ", it would have been obvious to a person of ordinary skill in the art at the time the invention was made to provide the fuel injector of Ohmori et al. with monitoring a glitch detection signal indicative of spill valve opening and modifying the first drive current signal to provide the second actuation pulse at a time, relative to termination of the spill valve opening period, in dependence upon the glitch detection signal in view of the teaching to Archer et al., in order to



ensure that fuel is delivered to the associated engine at the correct time (Col. 1, Lines 30-35 from Archer et al.)

With regards to claim 4, the patent to Ohmori et al. discloses all the limitations of the claimed subject matter except positively disclosing including monitoring said glitch detection signal periodically during injection events.

Archer et al. discloses including monitoring said glitch detection signal periodically during injection events (Col. 3, Lines 3-11). See rejection in Claim 3.

Claims 9-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ohmori et al. (US Patent No. 4,653,448) in view of Straub (US Patent No. 7,150,410)

With regards claim 9, the patent to Ohmori et al. discloses all the limitations of the claimed subject matter including wherein a control method for delivering a main injection of fuel followed by a post injection of fuel (i.e. fuel to be injected or post injection after the opening and closing of the spill and nozzle valves, See Figure 2), the method comprising: actuating a spill valve (74) and a nozzle control valve (126) to initiate the main injection of fuel, terminating the main injection of fuel by actuating the spill valve (74) at a first time to cause the spill valve (74) to move to an open state and (ii) actuating a nozzle control valve (126) at a second time to cause the nozzle control valve (126) to move into a closed state, subsequently actuating the spill valve (74) at a third time to cause the spill valve (74) to move from its open state to a closed state, and

initiating the post injection of fuel by actuating the nozzle control valve (126) to move into an open state (See Figure 2F), except positively disclosing whereby the difference between the first and third times is selected to provide a relatively high pressure post injection of fuel so as to reduce smoke emissions levels.

Straub discloses whereby the timing of the injection valves is selected to provide a relatively high pressure post injection of fuel so as to reduce smoke emissions levels (Col. 1, Lines 25-45).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify the timing of Ohmori et al. with whereby the difference between the first and third times is selected to provide a relatively high pressure post injection of fuel so as to reduce smoke emissions levels in view of the teaching to Straub, in order to meet the demands of greater fuel economy, cleaner burning and fewer emissions (Col. 1, Lines 35-40 from Straub)

With regards to claim 10, the combination of Ohmori et al. and Straub discloses all the limitations of the claimed subject matter including whereby the spill valve (74) is actuated to move between its open and closed states by modifying a spill valve drive current signal (Figure 2D).

With regards to claims 11 and 12, the patent to Ohmori et al. discloses all the limitations of the claimed subject matter including wherein the relative timing between opening and closure of the spill valve (74) is selected to ensure a pressure (Col. 2,

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Lines 34-42), except positively disclosing the post injection pressure is at least 1700 or 2000 bars.

Straub discloses an injection pressure is at least 1700 bar (2000 bars or approximately 30,000 psi, Col. 1, Line 33).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify the predetermined injection pressure of Ohmori et al. with the post injection pressure is at least 1700 bar. in view of the teaching to Straub, in order to meet the demands of greater fuel economy, cleaner burning and fewer emissions (Col. 1, Lines 35-40 from Straub)

### ***Conclusion***

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Chelky (US Patent Publication 2007/0227493) shows the current state of the art.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to KEITH COLEMAN whose telephone number is (571)270-3516. The examiner can normally be reached on 5:30-4:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stephen Cronin can be reached on (571)272-4536. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

KAC

/K. C./

Examiner, Art Unit 3747

/Stephen K. Cronin/

Supervisory Patent Examiner, Art Unit 3747